

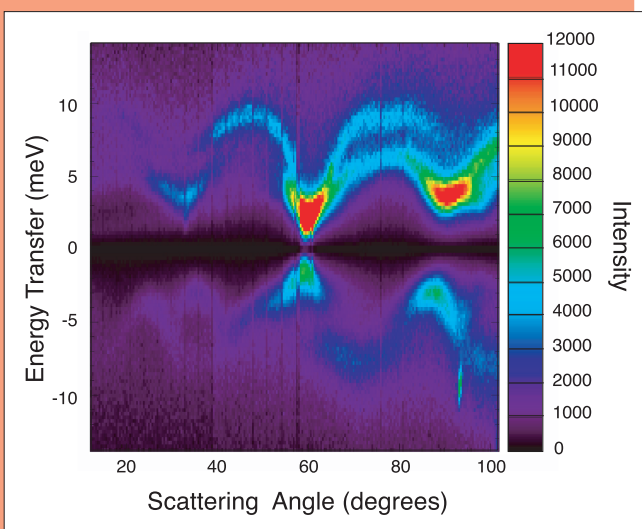
## High-Resolution Chopper Spectrometer (PHAROS)

The high-resolution neutron chopper spectrometer, PHAROS, is designed for studies of fundamental excitations in condensed-matter systems. The instrument provides 2% to 4% incident energy resolution and uses a high-speed Fermi chopper to obtain monochromatic incident energies in the range from 10 meV to 2 eV. The sample is positioned 20 m from a chilled-water moderator. The spectrometer consists of an evacuated, shielded flight path with 10 m<sup>2</sup> of meter-long position-sensitive detectors located at a distance of 4 m from the sample and covering scattering angles between -10° and 145°. PHAROS can accommodate the full range of inelastic-scattering experiments on liquid, polycrystalline, and single-crystal samples. This includes phonon and spin-wave dispersions, phonon densities-of-states, magnetic excitations, momentum distributions, spin-orbit and crystal-field levels, chemical spectroscopy, and measurements of  $S(Q, \omega)$  in disordered systems. In addition, the low-angle detectors are available for use at distances between 4 and 10 m with scattering angles down to 0.65°, thus making it suitable for high-resolution inelastic studies (<1% resolution) at low  $Q$ .

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Instrument scientist Rob McQueeney, on top of the PHAROS instrument, examines the vacuum pump.



Phonon dispersion of Pb at room temperature as measured by PHAROS. The intensity of phonon branches are shown as a function of energy transfer and scattering angle. The data can be used to obtain the forces between Pb atoms and verify first-principles electronic-band-structure calculations used in equation-of-state efforts.

### PHAROS Specifications

Incident energy resolution	$\Delta E_i/E_i = 2\%$ to 4%
Moderator-chopper distance	18 m
Chopper-sample distance	2 m
Moderator	Chilled water at 283 K
Fermi chopper frequency	60 - 600 Hz
Fermi chopper diameter	10 cm
Fermi chopper slit spacing	1 mm or more
Sample size	up to 5 cm x 7.5 cm
Detectors	10 m <sup>2</sup> of meter-long position-sensitive detectors at 4 m from the sample and scattering angles between -10° and 145°; 1 m <sup>2</sup> of detectors in forward scattering position can be moved up to 10 m from the sample.